(12) UK Patent Application (19) GB (11) 2 218 438 (13) A

(43) Date of A publication 15.11.1989

(21) Application No 8909526.9

(22) Date of filing 26.04.1989

(30) Priority data
(31) 8810017 (32) 27.04.1988 (33) GB

(71) Applicant
Chelsea Artisans Plc

(Incorporated in the United Kingdom)

Unit 7, The Ember Centre, Lyon Road, Hersham, Surrey, KT12 3PU, United Kingdom

(72) Inventor
Roger John Leach

(74) Agent and/or Address for Service
Graham F Coles
Graham Coles & Co, 24 Seeleys Road, Beaconsfield, Buckinghamshire, HP9 1SZ, United Kingdom

(51) INT CL⁴
E04C 2/04, B32B 5/18 9/04 15/08

(52) UK CL (Edition J)
E1D DCF2 DF151 D1072 D2145 D401 D405 D412 D414 D421
B5N N0514 N0518 N0528 N0904 N1508 N1514 N1520 N2704 N2712 N2740
B5P P175 P176 P178 P18X P181 P195 P196 P199 P20Y P204 P205 P207 P211 P224 P225 P226 P23X P248 P254 P374 P377 P383 P389 P401 P408 P409 P453 P455 P459 P46X P46Y P468 P470 P476 P519 P56X P563 P595 P596 P617 P618 P619 P728 P729 P76X P766
U1S S1210 S1700

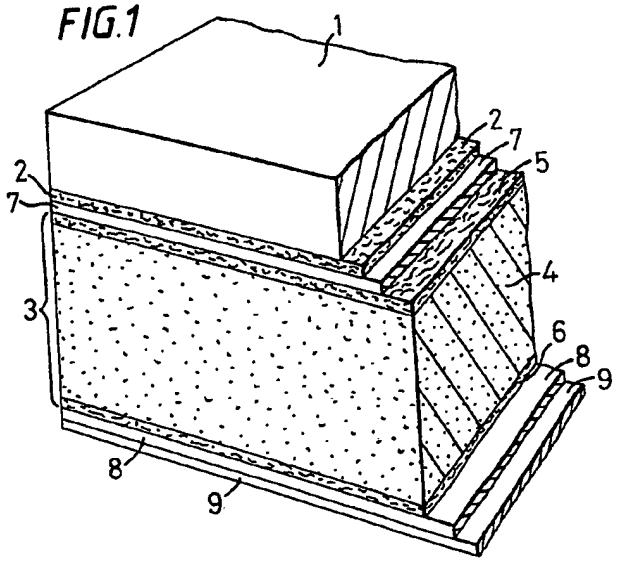
(56) Documents cited
GB 1389952 A GB 1315725 A EP 0255795 A2
EP 0238444 A2 EP 0154618 A2

(58) Field of search
UK CL (Edition J) B5N, E1D
INT CL⁴ E04C

(54) Mineral faced panels

(57) A marble-faced laminate includes a substantially rigid panel 3 having a core 4 of foamed polyisocyanurate (or polyisocyanurate-modified polyurethane) sandwiched between two reinforced skins 5 and 6. The facing is a thin marble sheet 1 which has a resin-bonded glass-fibre backing 2 that is bonded by an epoxy-resin layer 7 to skin 5 of the panel 3, and an aluminium foil 9 is bonded to the other skin 6 via an epoxy-resin layer 8. The backing 2 is applied (as 11 or 12, Fig 2) to the marble before the sheet is cut from a larger block (10 Fig 2), and the skins 5 and 6 are formed during manufacture of the panel 3 by allowing the uncured plastics of the core 4 to soak into glass fibre, so that with foaming and curing of the core 4, dense skins of the resin reinforced with partially-exposed glass fibres are formed. Stone other than marble (eg granite) may be used for the facing, and instead of sheets the marble or other stone may be provided in blocks or other divided (eg chippings) form on the glass-fibre backing layer 2. Plaster of Paris, clays and earths may also be used as facings.

FIG.1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 218 438 A

FIG.1

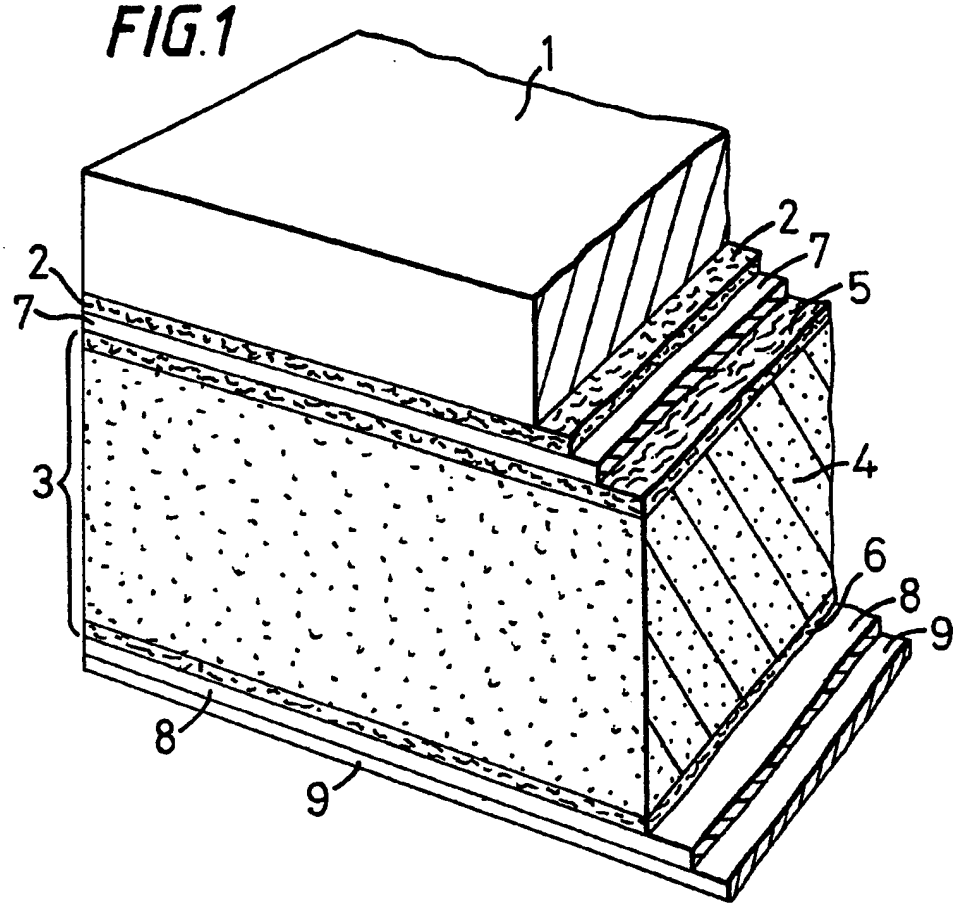
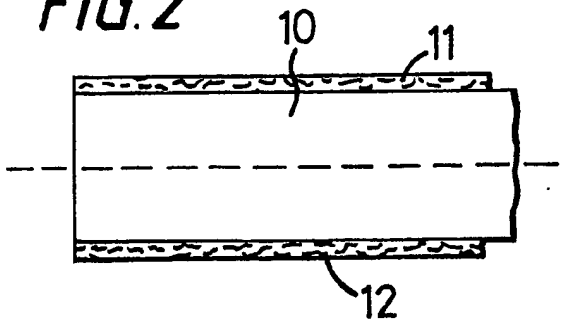


FIG.2



Faced Articles

This invention relates to articles having stone or other mineral facing, and to methods of manufacturing them.

The invention is concerned especially, though not exclusively, with the provision of articles faced with marble or other stone, and more especially in this respect with facilitating the provision of marble- or other stone-facings in, for example, building and other construction works.

According to one aspect of the present invention there is provided an article having a stone or other mineral facing wherein the facing is carried by a substantially rigid panel that comprises a body of foamed plastics having reinforced skins.

The panel may be of foamed polyisocyanurate or a polyisocyanurate-modified polyurethane foam, and the skins may be of the plastics material reinforced with glass or other fibres.

The facing mineral may be marble or other stone (for example, granite), and in this respect may be provided in sheet or divided form. More especially, in the latter respect, the facing may take the form of blocks, chippings or an aggregate, or combinations of any of these. Furthermore, clays or earths may be used as facing materials. Whatever the material or form of the facing, however, it may in general be preferable to provide the material with a backing layer, for example of resin-bonded glass fibre, by which the facing is bonded or otherwise secured to one of the reinforced skins of the foamed-plastics panel. Balance in the structure may be achieved by material, for example

resin, bonded to a said reinforced skin on the opposite side of the panel from the facing; a metal or other film may be bonded to the surface of this layer remote from the panel, for sealing or other purpose.

According to another aspect of the present invention, a method of manufacturing an article having a stone or other mineral facing, includes the step of bonding the facing to a substantially rigid panel that comprises a body of foamed plastics having reinforced skins, the facing being bonded in this step to one of the reinforced skins.

The method may include a step of bonding the facing material, in sheet or divided form, to a backing layer (for example, of resin-bonded glass fibre) prior to bonding the facing to the panel, the bonding of the facing to the panel being carried out in these circumstances by bonding the backing layer to the said one reinforced skin.

Furthermore, the method may include the step of bonding a layer of resin or other material to a said reinforced skin on the opposite side of the panel from the facing, and at the same time, or later, bonding a metal or other film to the surface of the said layer of resin or other material, for sealing or other purpose.

The reinforced skins of the panel, may be of the said plastics material (for example, polyisocyanurate or polyisocyanurate-modified polyurethane) reinforced with glass or other fibres, such skins being formed integrally with the remainder of the said body of the panel during foaming and curing of the material.

A marble-faced laminate for building construction works, and a method of manufacturing it, will now be

described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 shows the laminate partly cut away; and

Figure 2 illustrates a step in manufacture of the laminate.

Referring to Figure 1, the laminate, which is rectangular with side dimensions of 1200 mm x 2400 mm and a thickness slightly in excess of 28 mm, is faced with a single, thin sheet 1 of marble. The marble sheet 1, which has a backing layer 2 composed (to a thickness of 1 mm) of glass fibres that are bonded together and to the sheet 1 by an epoxy resin, is carried by a foamed-plastics panel 3.

The panel 3, which may be Celotex "ENERGY-LOK" board, has a body or core 4 that is of foamed polyisocyanurate (or a polyisocyanurate-modified polyurethane foam). The core 4 has a thickness of 18 mm and is sandwiched between two strengthening skins or layers 5 and 6 respectively, each of 1 mm thickness. The layers 5 and 6 are formed during manufacture of the panel 3, by allowing the uncured foam material for the core 4 to soak into mats of uncoated glass fibres, so that as the core 4 is expanded (foamed) and cured, dense skins of polyisocyanurate resin reinforced with the glass fibres, form (as the layers 5 and 6) on the two major surfaces of the panel-core 4. The glass-fibre reinforced skins or layers 5 and 6 afford rigidity to the tough and resilient low-density core 4, and partially-exposed fibres on their surfaces enable strong bond attachments to be achieved with the skins.

The marble sheet 1 is attached to the panel 3 by means of a layer 7 of epoxy adhesive that bonds the backing layer 2 to the skin or layer 5, and another layer 8 of

that same adhesive is bonded, with an overlying film 9 of aluminium foil, to the layer 6. The layers 7 and 8 are both 1 mm thick, and the aluminium film 9 has a thickness of 0.7 mm.

The marble-faced laminate described is suitable for use generally in any situation in which presentation of a marble surface or facing is required. More especially, it can be used where slab marble is conventionally used in building construction and other installation works, but also in other applications for which slab marble is normally considered unsuitable. For example, the laminate may be used as a cladding (such as for a ceiling or within an elevator) or otherwise (such as for a fascia to a shop front), in circumstances where use of conventional marble would be regarded as unsuitable because of weight *versus* strength, or cost factors. In regard to weight, the laminate is generally very much lighter than (for example, only one third of the weight of) marble slab of comparable strength. Indeed, the thickness of the marble sheet 1 in the laminate described above, is merely 7 mm, but it is given good supporting strength, owing to the inherent rigidity of the panel 3 as enhanced by the resin bonded-facings, without adding significant weight; the panel 3 has a compression strength (at 10% compression) of the order of 198 kN/m^2, and good flexural strength. The laminate, furthermore, has the advantage over a comparable marble slab, of providing a significant degree of added thermal insulation.

The low-weight factor, combined with strength and rigidity, of the laminate, enables it to be more readily and generally supported than conventional marble slabs. More particularly, the laminate may be satisfactorily attached to timber frameworks (for example, studding in partition walls) and lightweight brickwork (for example, breeze blocks), possibilities

not generally available where conventional marble slabs are used. Also, the laminate has adequate rigidity and shock resistance to allow it is to be used without a back-supporting surface or wall, and with the laminate retained simply by its edges (for example, in a lift-and-drop form of installation where the top and bottom edges of the vertically-positioned laminate are located in horizontal channelling); this is not generally possible with conventional marble slabs. Furthermore, the laminate has been found to have good dimensional stability through a wide range of temperature and humidity conditions (less than 1% change over a long period at 70°C and 95% relative humidity). In particular it has been found to retain its flatness, without the need for thick-steel or other substantial restraint that might otherwise be expected to be required.

The facing sheet 1 in the laminate described above is a single marble sheet having a face area of 1200 mm x 2400 mm and a thickness of 7 mm. Marble of such face area requires a considerably larger thickness than 7 mm to be self-supporting, and even larger if it is to be capable of resisting shock without breaking. Accordingly, the construction of laminate described, enables a marble-faced product to be provided with significantly less bulk of heavy and expensive marble than would otherwise be the case using conventional marble slabs, and to do this with improvement in strength, thermal insulation and wider possible application.

The sheet 1 of marble is too thin to be safely handled on its own without breakage, during manufacture of the laminate. As illustrated in Figure 2, the sheet 1 is produced by dividing a marble block 10 of twice the required thickness, into two sheets, but this is done only after mats 11 and 12 of glass fibres have been

bonded to the major faces of the block 10 by an epoxy resin. The mats 11 and 12 in combination with the cured resin, reinforce the two halves of the block 10 so that each half can now be handled safely in laminate manufacture; each half in this respect, provides the sheet 1 (with its glass-fibre backing layer 2) that, as described above with reference to Figure 1, is bonded to the panel 3.

Bonding of the backed sheet 1 to the panel 3 (that is to say, formation of the layer 7 which unites the layers 2 and 5) is carried out using an epoxy adhesive that has particularly good adhesion to the cured backing layer 2. This adhesive is based on a solvent-free liquid epoxy resin modified with a reactive diluent, namely iso-octyl glycidyl ether, and a thixotropic agent; Peridite Epoxy Resin PZ 2598 is suitable. The reactive diluent reduces the viscosity of the resin and thus improves its wetting characteristics (good wetting is important for good adhesion), and the thixotropic agent imparts structure to the resin so that it does not drain from high spots of the contact surfaces. The hardener used is based on a polyamide that is modified so that when mixed with the epoxy resin, the mixture can be thinned with water; Peridite Epoxy Hardener H 11-39 is suitable. Although the mixture of resin and hardener is not solvent free (thus does not have minimum cure-shrinkage) it has a volatile content of only some 12%.

The same adhesive as that used to bond the backing layer 2 of the sheet 1 to the skin or layer 5 of the panel 3, is used to bond the aluminium film 9 to the layer 6 and form the uniting layer 8 between them. In both cases, the adhesive is applied initially to the non-panel surface, that is to say, to the layer 2 and film 9, before contact with the panel-skin is made to establish the bond.

Although the above description has referred to specific dimensions of the laminate (and its constituent parts), it should be understood that these are given solely by way of example, and that laminates of larger or smaller dimension may be readily constructed in accordance with the present invention. Moreover, the laminate described may be used in construction of shop or other furniture, rather than for building construction works; for example, the laminate may be used to provide marble work surfaces or fronts to decks and counters.

Stone other than marble, for example granite, may be used for facing the laminate, and rather than using a single sheet as described, the marble or other stone may be provided in blocks or other divided form on the glass-fibre backing layer 2. The stone may be in the form of chippings or an aggregate, and in this case the facing with its backing layer 2 may be formed by spraying chopped glass-fibre together with a bonding resin into a tray, covering the fibre-resin mass in the bottom of the tray with an excess of the stone, rolling the stone, curing the resin and then shaking the excess stone away upon removal of the cured fibre-resin mat with its adhering stone, from the tray (provision for ready release from the tray may be provided using polytetrafluorethylene or polythene). However, other mineral facing materials may be used; in particular plaster of Paris, clays and earths may be utilised, such materials being provided on a backing layer, for example of glass fibre and soaked in bonding resin, before bonding to the foamed-plastics panel.

Claims:

1. An article having a stone or other mineral facing wherein the facing is carried by a substantially rigid panel that comprises a body of foamed plastics having reinforced skins.

2. An article according to Claim 1 wherein the facing is stone in sheet form.

3. An article according to Claim 1 or Claim 2 wherein the facing mineral has a backing layer which is bonded to one of the reinforced skins of the foamed plastics.

4. A marble-faced article wherein a sheet of marble is bonded via a reinforcing backing layer to one of opposed reinforced-skins of a substantially rigid foamed-plastics panel.

5. An article according to Claim 3 or Claim 4 wherein the backing layer is of resin-bonded glass fibre.

6. An article according to any one of the preceding claims wherein a layer of resin or other material is bonded to a said reinforced skin on the opposite side of the panel from the facing.

7. An article according to Claim 6 wherein a metal or other film is bonded to the surface of the said layer of resin or other material, which is remote from the panel.

8. An article according to any one of the preceding claims wherein the skins are of the plastics material reinforced with fibres.

9. An article according to Claim 8 wherein the fibres are of glass.

10. An article according to any one of the preceding claims wherein the foamed plastics material is foamed polyisocyanurate or polyisocyanurate-modified polyurethane.

11. A method of manufacturing an article having a stone or other mineral facing, including the step of bonding the facing to a substantially rigid panel that comprises a body of foamed plastics having reinforced skins, the facing being bonded in this step to one of the reinforced skins.

12. A method according to Claim 11 wherein the facing is bonded to a backing layer prior to being bonded to the panel, and wherein bonding of the facing to the panel is carried out by bonding the backing layer to the said one reinforced skin.

13. A method according to Claim 12 wherein the backing layer is of resin-bonded glass fibre.

14. A method according to any one of Claims 11 to 13 including the step of bonding a layer of resin or other material to a said reinforced skin on the opposite side of the panel from the facing.

15. A method according to Claim 14 wherein a metal or other film is bonded to the surface of the said layer of resin or other material, which is remote from the panel.

16. A method according to any one of Claims 11 to 15 wherein the skins are of the said plastics material reinforced with fibres, such skins being formed

integrally with the remainder of the said body during foaming and curing of the material.

17. A method according to Claim 16 wherein the fibres are of glass.

18. A method according to any one of Claims 11 to 17 wherein the foamed plastics material is foamed polyisocyanurate or polyisocyanurate-modified polyurethane.

19. A method of manufacturing an article having a marble facing, substantially as hereinbefore described with reference to the accompanying drawing.

20. An article manufactured by the method of any one of Claims 11 to 19.

21. A marble-faced article substantially as hereinbefore described with reference to Figure 1 of the accompanying drawing.

Published 1989 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office. Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent, Con. 1/87